

CLAIMS

1. A method of base station change, the base station transferring packet switched communications between a mobile station and a support node, the method characterized in that the base station change is of lossless type allowing lossless base station change of packet switched communications in unacknowledged mode between the mobile station and the support node.
2. The method according to claim 1 characterized in that a protocol entity maintains N-PDU send and receive sequence numbers, and GTP T-PDU uplink and downlink sequence numbers for each packet flow subject to base station change of lossless type, the support node acting as source support node during the base station change, forwarding maintained sequence number information to a target support node of the base station change.
3. The method according to claim 2 characterized in that downlink N-PDU and downlink GTP T-PDU sequence numbers are provided along with each N-PDU forwarded from the source support node to the target support node.
4. The method according to claim 2 characterized in that LLC data buffered in source BSS that has not been sent to, or acknowledged by, the mobile station at the point in time when the source BSS sends the PS handover command message to the mobile station is deleted.
5. The method according to claim 4 characterized in that a status message is sent back to the source support node telling it how many LLC PDUs have been deleted.

6. The method according to claim 5 c h a r a c t e r -
i z e d i n that the status message provides part of the
one or more deleted LLC PDUs.

7. The method according to claim 6 c h a r a c t e r -
5 i z e d i n that the status message provides the header
of the one or more deleted LLC PDUs.

8. The method according to claim 2 c h a r a c t e r -
i z e d i n that a set of N-PDUs sent down to the source
BSS are buffered in the support node for each packet flow
10 subject to lossless PS handover.

9. The method according to claim 2 c h a r a c t e r -
i z e d i n that a PS handover command message contains
an RLC ACK/NACK report allowing a mobile station to
determine which one or more N-PDUs have been completely
15 received by the network.

10. The method according to claim 2 c h a r a c t e r -
i z e d i n that a mobile station starts uplink
transmission upon handover to a target cell, by an
estimated next uplink N-PDU that was not acknowledged by
20 lower layers in a source cell from which the mobile station
was handed over to the target cell.

11. The method according to claim 2 c h a r a c t e r -
i z e d i n that a PS handover command sent from the
support node to a source BSS includes expected Receive N-
25 PDU sequence number, at which a mobile station should start
transmission in a target cell for each uplink packet flow
subject to lossless handover.

12. The method according to claim 2 c h a r a c t e r -
i z e d i n that a mobile station buffers one or more
30 uplink N-PDUs which have been confirmed according to RLC.

13. The method according to claim 2 c h a r a c t e r -
i z e d i n that uplink and downlink G-PDU sequence
numbers associated with uplink and downlink N-PDUs are
recorded while in unacknowledged mode between the mobile
5 station and the support node.

14. The method according to claim 1 c h a r a c t e r -
i z e d i n that the base station change allows an entire
data transfer session in unacknowledged mode.

15. The method according to claim 14 c h a r a c t e r -
10 i z e d i n that the data transfer session is a session
of data file transfer.

16. The method according to claim 1 c h a r a c t e r -
i z e d i n that the packet switched communications in
unacknowledged mode between the mobile station and the
15 support node concerns unacknowledged mode of LLC protocol.

17. The method according to claim 1 comprising a mode of
operation c h a r a c t e r i z e d b y recording one or
more sequence numbers of one or more protocol data units in
both uplink and downlink.

20 18. The method according to claim 17 c h a r a c t e r -
i z e d i n that the protocol data units are N-PDUs.

19. The method according to claim 17 c h a r a c t e r -
i z e d i n that the protocol data units are G-PDUs.

20. The method according to claim 1 c h a r a c t e r -
25 i z e d i n that SNDCP sequence continuity is maintained
across a support node involved in packet switched base
station change.

21. The method according to claim 1 c h a r a c t e r -
i z e d i n that one or more SN-UNITDATA protocol data
unit includes one or more N-PDU.

22. The method according to claim 21 c h a r a c t e r -
5 i z e d i n that N-PDU number is included in a header of
SN-UNITDATA protocol data unit.

23. The method according to claim 1 c h a r a c t e r -
i z e d i n that a support node connected to a source
base station or base station subsystem to be changed in-
10 f o r m s a mobile station, also connected to the base station
or base station subsystem, on a next expected uplink proto-
col data unit to be received.

24. The method according to claim 1 c h a r a c t e r -
i z e d i n that a mobile station connected to a source
15 base station or base station subsystem to be changed in-
f o r m s a source support node, also connected to the base
station or base station subsystem, on a next expected down-
link protocol data unit to be received.

25. The method according to claim 23 or 24 c h a r a c -
20 t e r i z e d i n that the base station or base station
subsystem relays the information between mobile station and
support node with no required processing of the
information.

26. The method according to any of claims 23-25 c h a r -
25 a c t e r i z e d i n that the source base station or
base station subsystem is allowed to continue receiving
uplink data while emptying downlink buffers as a response
to a PS Handover Command.

27. The method according to any of claims 1-26 c h a r -
30 a c t e r i z e d i n that the protocol data units are
compliant with Sub-Network Dependent Convergence Protocol.

28. The method according to claim 27 c h a r a c t e r -
i z e d i n that SNDCP entities in a source support node
buffers one or more downlink N-PDUs.

29. The method according to claim 28 c h a r a c t e r -
5 i z e d i n that the source support node buffers a number
of N-PDUs corresponding to the delay attribute of the asso-
ciated packet flow.

30. The method according to claim 29 c h a r a c t e r -
i z e d i n that the buffered N-PDUs are forwarded to a
10 target support node during the base station change.

31. The method according to claim 30 c h a r a c t e r -
i z e d i n that the received forwarded N-PDUs in target
support node are forwarded to the mobile station.

32. The method according to claim 31 c h a r a c t e r -
15 i z e d i n that the one or more N-PDUs are forwarded to
the mobile station when the support node has received a PS
Handover Complete message.

33. The method according to claim 27 c h a r a c t e r -
i z e d i n that one or more downlink N-PDUs are buffered
20 in SNDCP entities in a target support node.

34. The method according to claim 33 c h a r a c t e r -
i z e d i n that the target support node buffers a number
of uplink N-PDUs corresponding to the number of N-PDUs
received from the source support node.

35. The method according to claim 27 c h a r a c t e r -
25 i z e d i n that one or more uplink N-PDUs are buffered
in SNDCP entities in a mobile station.

36. The method according to claim 35 c h a r a c t e r -
i z e d i n that the mobile station buffers a number of

N-PDUs corresponding to the maximum delay of RLC/MAC acknowledgement of transmission of LLC PDU.

37. A mobile station for packet switched communications communicating over a communications network including base stations and one or more support nodes, the mobile station characterized by processing means operating according to one or more protocols receiving protocol data units, the processing means extracting information for the mobile station to inform the network of next expected downlink protocol data unit in association with packet switched base station change allowing lossless base station change of packet switched communications.

38. A mobile station for packet switched communications communicating over a communications network including base stations and one or more support nodes, the mobile station characterized by processing means operating according to one or more protocols transferring protocol data units and receiver receiving informing from the network on next expected uplink protocol data unit in association with packet switched base station change allowing lossless base station change of packet switched communications.

39. The mobile station according to claim 37 or 38 characterized in that the protocol data units are compliant with Sub-Network Dependent Convergence Protocol.

40. The mobile station according to claim 39 characterized by a buffer for buffering one or more uplink N-PDUs which have been confirmed according to RLC.

41. The mobile station according to claim 40 characterized in that the mobile station starts

uplink transmission upon handover to a target cell, by transmitting an estimated next uplink N-PDU that was not acknowledged by lower layers in a source cell from which the mobile station was handed over to the target cell.

5 42. The mobile station according to claim 41 c h a r -
a c t e r i z e d b y the processing means recording ac-
cording to the Sub-Network Dependent Convergence Protocol
N-PDU sequence numbers of N-PDUs received or transferred.

10 43. The mobile station according to claim 39 or 40
c h a r a c t e r i z e d b y protocol data units includ-
ing N-PDUs.

44. The mobile station according to any of claims 41-43
c h a r a c t e r i z e d b y buffer means, buffering
uplink N-PDUs

15 45. The mobile station according to claim 44 c h a r -
a c t e r i z e d i n that the buffer size is suffi-
ciently large for a number of N-PDUs corresponding to the
maximum delay of RLC/MAC acknowledgement of transmission of
LLC PDU to be buffered.

20 46. The mobile station according to any of claims 39-43
c h a r a c t e r i z e d i n that the information on
next expected protocol data unit is transferred in a mes-
sage initiating or completing a change of base station or
handover as regards the mobile station.

25 47. The mobile station according to claim 46 c h a r -
a c t e r i z e d i n that the message initiating or com-
pleting a change of base station or handover is a PS Hando-
ver Command or PS Handover Complete message.

30 48. A support node in a packet switched communications
network comprising base stations for communications involv-

ing at least one mobile station, the support node characterized by processing means operating according to one or more protocols receiving protocol data units, the processing means extracting information for the support node to inform a mobile station of next expected uplink protocol data unit in association with packet switched base station change of the at least one mobile station.

49. A support node in a packet switched communications network comprising base stations for communications involving at least one mobile station, the support node characterized by processing means operating according to one or more protocols transferring protocol data units and receiver receiving informing from the at least one mobile station on next expected downlink protocol data unit in association with packet switched handover allowing lossless base station change of packet switched communications.

50. The support node according to claim 49 characterized by a protocol entity for maintaining N-PDU send and receive sequence numbers, and GTP T-PDU uplink and downlink sequence numbers for each packet flow subject to base station change of lossless type, the support node acting as source support node during the base station change, forwarding maintained sequence number information to a target support node of the base station change.

51. The support node according to claim 50 characterized by processing means for providing downlink N-PDU and downlink GTP T-PDU sequence numbers along with each N-PDU forwarded to the target support node.

52. The support node according to claim 50 characterized by a buffer for buffering a set of N-PDUs

sent down to the source BSS for each packet flow subject to lossless PS handover.

53. The support node according to claim 50 c h a r a c -
t e r i z e d b y processing means for including an RLC
5 ACK/NACK report in a PS handover command message, allowing
a mobile station to determine which one or more N-PDUs have
been completely received by the network.

54. The support node according to claim 50 c h a r a c -
t e r i z e d i n that a PS handover command sent from
10 the support node to a source BSS includes expected Receive
N-PDU sequence number, at which a mobile station should
start transmission in a target cell for each uplink packet
flow subject to lossless handover.

55. The support node according to claim 50 c h a r a c -
15 t e r i z e d b y recording means for recording uplink
and downlink G-PDU sequence numbers associated with uplink
and downlink N-PDUs while in unacknowledged mode between
the mobile station and the support node.

56. The support node according to claim 49 c h a r a c -
20 t e r i z e d i n that the base station change is within
GERAN or between GERAN and UTRAN.

57. The support node according to claim 49 c h a r a c -
t e r i z e d i n that a protocol entity of the support
node maintains sequence continuity over the support node.

58. The support node according to claim 57 c h a r a c -
25 t e r i z e d i n that the protocol entity operates
according to SNDCP.

59. The support node according to claim 49 c h a r a c -
t e r i z e d i n that upon completion of a packet
30 switched base station change, the support node sustaining

the base station changed to starts transmissions of protocol data units to the at least one mobile station at the next protocol data unit expected by the at least one mobile station.

5 60. The support node according to claim 59 characterized by receive means, the transmissions being started upon the receive means receiving a PS Handover Complete message.

10 61. The support node according to any of claims 48-60 characterized in that the protocol data units are compliant with Sub-Network Dependent Convergence Protocol.

15 62. The support node according to claim 61 characterized by the processing means recording according to the Sub-Network Dependent Convergence Protocol N-PDU sequence numbers of N-PDUs received or transferred.

20 63. The support node according to claim 61 characterized by the processing means recording according to the Sub-Network Dependent Convergence Protocol G-PDU sequence numbers of G-PDUs received or transferred.

64. The support node according to any of claims 61-63 characterized by buffer means, buffering downlink N-PDUs

25 65. The support node according to claim 64 characterized in that the buffer size is sufficiently large for a number of N-PDUs corresponding to a delay attribute of the associated packet flow.

30 66. The support node according to any of claims 48-65 characterized in that the information on next expected protocol data unit is transferred in a mes-

sage initiating or completing a change of base station or handover as regards the at least one mobile station.

67. The support node according to claim 66 c h a r a c -
t e r i z e d i n that the message initiating or complet-
5 ing a change of base station or handover is a PS Handover
Command or PS Handover Complete message.

68. The support node according to claim 64 or 65
c h a r a c t e r i z e d i n that the buffered protocol
data units are transferred upon packet switched base sta-
10 tion change to a support node sustaining packet switched
communications over the base station to which the at least
one mobile station changed.

69. The support node according to claim 68 c h a r a c -
t e r i z e d i n that the buffered protocol data units
15 are transferred upon completion of a preparation phase of
the packet switched base station change.

70. The support node according to any of claims 48-69
c h a r a c t e r i z e d i n that the support not is a
Serving GPRS Support Node.

20 71. A base station entity in a packet switched communica-
tions network comprising at least one support node for com-
munications involving at least one mobile station, the base
station entity c h a r a c t e r i z e d b y receive
means, transmit means and buffer means, the buffer means
25 buffering downlink protocol data units, the buffer means
being emptied of protocol data units destined for the at
least one mobile station, the protocol data units being
transmitted by the transmit means upon the receive means
receiving a command of packet switched base station change,
30 as regards the one mobile station, from the at least one
support node.

72. The base station entity according to claim 71
c h a r a c t e r i z e d b y processing means for
deleting buffered LLC data that has not been sent to, or
acknowledged by, the mobile station at the point in time
5 when the source BSS sends the PS handover command message
to the mobile station.

73. The base station entity according to claim 72
c h a r a c t e r i z e d b y sending means for sending a
status message back to the source support node telling it
10 how many LLC PDUs have been deleted.

74. The base station entity according to claim 73
c h a r a c t e r i z e d i n that the status message
provides part of the one or more deleted LLC PDUs.

75. The base station entity according to claim 74
15 c h a r a c t e r i z e d i n that the status message
provides the header of the one or more deleted LLC PDUs.

76. The base station entity according to claim 71
c h a r a c t e r i z e d b y receive means and transmit
means, the receive means receiving uplink packet data from
20 the at least one mobile station while the buffer means be-
ing emptied of protocol data units destined for the at
least one mobile station.

77. A communications system c h a r a c t e r i z e d
b y means for carrying out the method in any of claims
25 1-37.

78. A communications system c h a r a c t e r i z e d
b y a plurality of mobile stations in any of claims 38-48,
the mobile stations being capable of reciprocal packet
switched communications.

79. A communications system characterized by a plurality of support nodes in any of claims 49-70.

80. A communications system characterized by a plurality of base station entities in any of claims
5 71-76.